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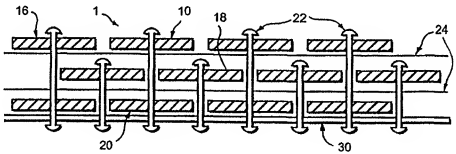
(54) Title: FLEXIBLE BODY ARMOUR



(57) Abstract

The invention provides flexible body armour comprising a flexible carrier layer (30) and a plurality of mutually staggered layers of armour plates (10) mounted on the carrier layer such that the plates are rotatable at least to a limited degree and form a continuous protective layer. The plates may be disc–like and rotatable about their centres. The plates in each layer are preferably orientated in a plane. The plates are mounted on the carrier layer by means of rivets or studs (22).

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TITLE: FLEXIBLE BODY ARMOUR

DESCRIPTION

TECHNICAL FIELD

The invention relates to flexible body armour and more particularly, but not exclusively, to body armour which is stab resistant.

BACKGROUND ART

One known type of flexible body armour is chain mail made of titanium. A problem with such armour is that it is not always effective against thin pointed stabbing weapons. There is also a problem of expense.

It is an object of the present invention to provide flexible body armour in which these problems are at least mitigated.

DISCLOSURE OF INVENTION

According to the present invention, there is provided flexible body armour comprising a plurality of superposed layers of discrete, substantially plate-like elements of resilient material mounted on a flexible carrier, in each of which layers the elements are juxtaposed edge to edge in rows and columns, the elements in each layer being staggered from those in the adjacent layer or layers such that the plurality of superposed layers forms a continuous protective layer. Preferably there are three superposed layers of discrete plate-like elements.

The plate-like elements may be made of metal or plastics, e.g. polycarbonate. Preferably the elements are made from a lightweight metal such as an alloy of aluminium. The elements may be of varying sizes, but are preferably substantially identical in size over the area of the armour. Smaller elements may however be useful for gap filling at the edges of the armour. The elements may be disc-shaped. The size may be between 10mm and 200mm in diameter and may be between 0.5mm and 20mm in thickness. The thickness may vary over the width of each plate-like element.

A substantially continuous separating layer may be provided between each layer of the elements, and the separating layer may be of a flexible material e.g. a plastics net-like material. Suitably the separating material may be of a knitted nylon net of small mesh size.

The elements may be mounted on the carrier by means of

studs or rivets. The studs or rivets may be made of metal or of plastics material. Preferably the plate-like elements are rotatable on the stud or rivet in which case each element is centrally mounted on the stud or rivet.

The carrier may be of any suitable flexible material, and may be of leather. A preferred material is a man-made plastics material resembling leather.

BRIEF DESCRIPTION OF DRAWINGS

The invention is diagrammatically illustrated by way of example in the accompanying drawings in which:-

Figure 1 is a plan view of the arrangement of plate-like elements in a lower protective layer of flexible body armour;

Figure 2 is a plan view of the arrangement of plate-like elements in the lower and intermediate protective layers of flexible body armour;

Figure 3 is a plan view of the arrangement of plate-like elements in a top protective layer of flexible body armour;

Figure 4 is a side view of the arrangement of the three layers shown in Figures 1 to 3;

Figures 5a is a front view of flexible body armour according to the invention formed into a vest,

Figure 5b is a perspective view of a harness on which flexible body armour as shown in Figure 5a may be mounted, and

Figure 5c is a perspective view of a flexible body

armour formed into a waistcoat.

BEST MODES FOR CARRYING OUT THE INVENTION

In the drawings there is shown flexible body armour (1) comprising three superposed layers (16,18,20) of substantially identical disc-shaped plate-like armour elements (10). The elements (10) are made of aluminium alloy and are mounted on a carrier layer (30) e.g. of a leather-like material, by means of rivets (22) supported in the carrier layer and passing through a central hole (12) in each plate-like element (10), such that each element is rotatable at least to a limited degree and is preferably freely rotatable on the rivet. Each element (10) is mounted on its own individual rivet.

In Figure 1, there is shown a lowest or bottom layer (16) of disc-shaped plate-like elements (10). The elements (10) are juxtaposed edge to edge in rows and columns and the centres (12) of the elements (10) in alternate rows are aligned. There are many gaps (14) between the elements (10).

In Figure 2, an intermediate layer (18) of the disc-shaped plate-like elements (10) has been laid over the lowest layer (16) of Figure 1. The layers (16, 18) are arranged such that the elements (10) in the bottom layer (16) are staggered from those in the intermediate layer (18). The centres (12) of the elements (10) in the bottom layer (16) are aligned with the edges of the elements (10) in the intermediate layer. Thus, the rows of elements (10)

in the bottom layer (16) are staggered from the rows of elements (10) in the intermediate layer (18). In this way, there are fewer gaps (14) in the armour, since some of the gaps between the elements (10) in the bottom layer (16) are covered by the elements (10) in the intermediate layer (18). The rivets for the intermediate layer project through the gaps (14).

In Figure 3, a top layer (20) of the disc-shaped plate-like elements (10) has been placed over the bottom and intermediate layers. The layers (16, 18, 20) are arranged such that the elements (10) in each of the three layers are staggered from those in other layers, with the rivets for the top layer projecting through remaining gap (14). The top layer (20) is arranged to cover the gaps (14) shown in Figure 2 and thus the plurality of superposed layers forms a continuous protective flexible layer of armour.

As shown in Figure 4, a separating layer (24) of flexible knitted nylon netting is positioned between the bottom and intermediate layers of elements (10) and between the intermediate and top layers of elements (10) to prevent unintended mis-positioning of the elements (10) by interleaving when the armour flexes in use.

As shown in Figures 5a, 5b and 5c, the body armour according to the invention may be made up into a stab-resistant vest (26) covering a part of the body to be protected, e.g. the chest, back, sides and shoulders. In Figure 5a, an armour vest (26)is arranged to protect the

chest and sides of the wearer and is attached to a harness (32) as shown in Figure 5b by means of releasable fastenings (34), e.g. of the Velcro (Registered Trade Mark) kind, fixed to the underside of the carrier layer (30). The harness (32) comprises shoulder straps (36) attached to a waist band (38), and the vest (26)is secured to the harness (32) by corresponding Velcro (Registered Trade Mark) type fastenings (34) on the shoulder straps and on the waist band.

Alternatively, as shown in Figure 5c, the body armour may be formed into a waistcoat (42), with fixed back armour (40) and arranged such that the wearer's chest region can be protected with further replaceable body armour, e.g. of the kind shown in Figure 5a.

INDUSTRIAL APPLICABILITY

The specific embodiment thus provides flexible body armour which is effective but inexpensive to produce and which is lightweight.

CLAIMS

1. Flexible body armour comprising a flexible carrier layer and a plurality of mutually staggered layers of armour plates mounted on the carrier layer such that the plates are rotatable at least to a limited degree and form a continuous protective layer.

2. Flexible body armour according to claim 1, wherein the plates are rotatable about their centres.

3. Flexible body armour according to claim 1 and claim 2, wherein the plates are disc-like.

4. Flexible body armour according to any one of claims 1 to 3, wherein the plates in each layer are orientated in a plane.

5. Flexible body armour according to any preceding claim, wherein the elements are juxtaposed edge to edge in rows and columns.

6. Flexible body armour according to any preceding claim, wherein the plates are of similar size and comprising three superposed layers of the plates.

7. Flexible body armour according to any preceding claim, wherein the thickness of each plate varies over the width of the plate.

8. Flexible body armour according to any preceding claim, comprising a substantially continuous flexible separating layer between each layer of the elements.

9. Flexible body armour according to claim 8, wherein the or each separating layer is of plastics net-like material.

10. Flexible body armour according to any preceding claim,

comprising studs or rivets mounted on the carrier layer and on which the plates are mounted.

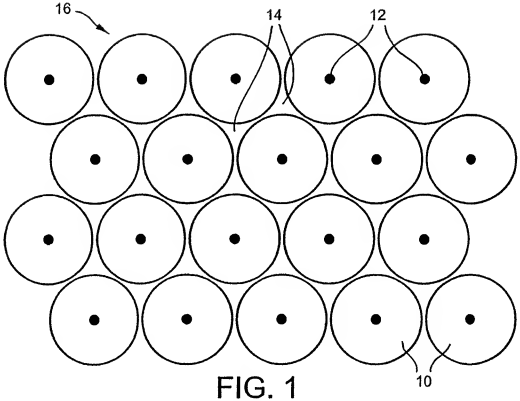

FIG. 1

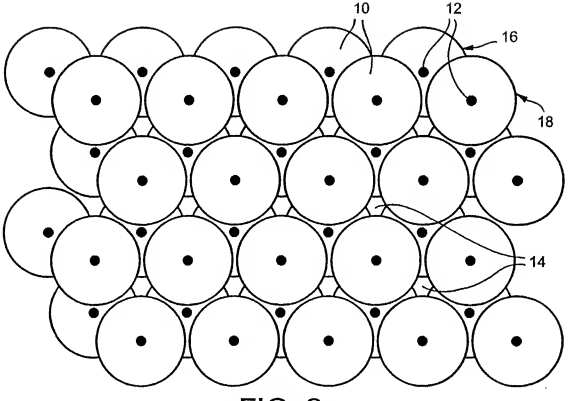

FIG. 2

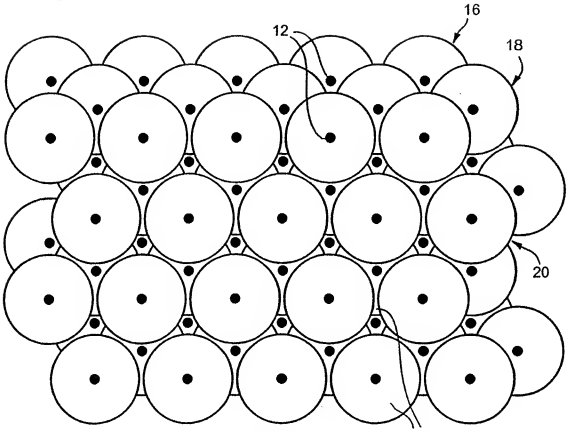

FIG. 3

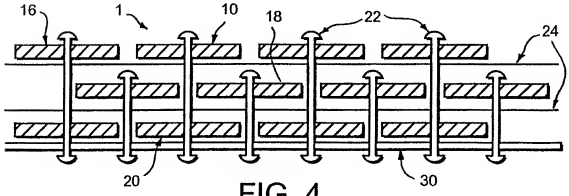

FIG. 4

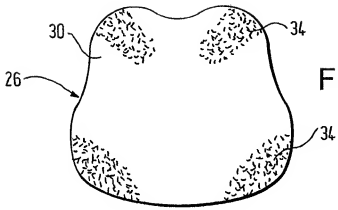

FIG. 5a

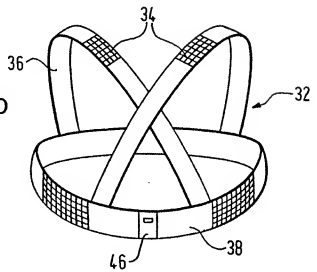

FIG. 5b

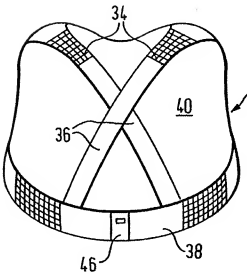

FIG. 5c

INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 99/03863

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F41H5/04 A41D31/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	column 2, line 66 -column 4, line 58; figures 1-7	6
Y	US 5 514 241 A (GOULD ET AL.) 7 May 1996 (1996-05-07)	6
A	column 6, line 41 - line 46; figures 7,8	1-5
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A	DE 197 07 375 A (SCHLEGELMILCH) 27 August 1998 (1998-08-27) the whole document	3-6

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